

**THE WORKING PROGRAM OF THE DISCIPLINE**

**Name of the discipline** Structural Design in Steel: Special Topics

**Recommended for educational field:** 08.04.01 Civil Engineering

**Specialization (profile):** Civil Engineering and Built Environment , Mechanics of materials and engineering structures, Built environment of smart city

## 1. Goals and objectives of the discipline:

**The purpose** of mastering the discipline "Structural Design in Steel: Special Topics" is to gain knowledge, skills, skills and experience in the field of theory and design of buildings and structures that characterize the stages of competence formation and ensure the achievement of the planned results of the development of the educational program.

**The main objectives** of the discipline "Structural Design in Steel: Special Topics" are:

- training of specialists of a wide profile in industrial and civil construction with an in-depth study of the basics of design, manufacture, installation, reinforcement of metal structures of buildings and structures;
- formation of skills of calculations and design of metal structures from the point of view of specific engineering tasks using design norms, standards, reference books;
- obtaining skills in the use of automation tools for the design of metal building structures.

## 2. Place of discipline in the structure of EP VO:

The discipline Structural design at steel belongs to the variable part of Block 1 of the curriculum. Its study is based on the material of previous disciplines, and it is also the basis for the study of subsequent disciplines of the curriculum, the list of which is presented in table 1

### Prior and subsequent disciplines aimed at the formation of competencies

№	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
General cultural competences			
General professional competencies			
Professional competencies (type of professional activity of a civil engineer)			
	PC-2;PC-4;PC-5;PC-6 PC-9; PC-11	Structural Analysis, Structural Dynamics, Basic Course(s) in Structural Steel Design, Structural Analysis, Structural Dynamics, Basic Course(s) in Structural Steel Design	Review of tension members, Review of compression members, Review of flexural members, Review of flexural members, Pure torsion of homogeneous sections; shear stresses due to bending of thin-wall open x-section, Torsional stresses in I-shaped steel sections
Vocational Competencies of Specialization Structural mechanics			

## 3. 3. Requirements for the results of mastering the discipline:

*PC-2- Development of design products based on the results of engineering design for urban planning activities*

*PC-4- Management of the complex of works on the operation and repair of civil buildings*

*PC-5- Organization of construction work at a capital construction facility*

*PC-6- Organizational, technical and technological preparation of construction production*

*PC-9- Conducting planned economic work in a construction organization*

*PC-11- Preparation of a section of design documentation for metal structures of buildings and structures*

*As a result of studying the discipline, the student must:*

**Know:**

- in the field of methods of mathematical analysis.
- know the state standards and be able to use them.
- basic methods of calculation and design of building structures.
- know the main theoretical provisions of the discipline:
- requirements for products and quality of information and theoretical support of the calculation base.
- knowledge of specialized software and computing systems.

**Be able to:**

- use modern information technologies.
- be able to use the appropriate computer developments.
- use modern software and computing systems for the calculation of building structures.
- use information technology to solve specific tasks.

- use information technology to solve specific tasks;
- use information technology in professional activities

**Own:**

- application of theoretical knowledge in practice.
- search for the necessary information.
- use of the latest automated projecting systems.
- use of information support in the calculation of structures and structures.
- organization of high-quality calculation of structures and structures.
- search for new software and computing systems to solve the tasks.

**4. Scope of discipline and types of educational work**

The total workload of the discipline is 3 credit units.

Type of educational work	Total hours	Semesters			
		2			
<b>Classroom Practice in Obtaining Professional Skills and Professional Experience (Research Practice). lessons (total)</b>	24	24			
Including:	-	-	-	-	-
<i>Lectures</i>	8	8			
<i>Practical lessons (PL)</i>	16	16			
<i>Seminars (S)</i>	-	-			
<i>Laboratory work (LW)</i>	-	-			
<b>Independent work (total)</b>	84	84			
hour	Total labor intensity	108	108		
	cred-its	3	3		

**5. Content of the discipline****5.1. Contents of discipline sections**

№	The name of the discipline section	Section content (topics)
1.	<b>Introduction to steel structures</b>	Introduction: Building codes, Seismic forces, Analysis, and design of complex structures. Loads, philosophy of design, steel and properties,
2.	<b>Beam-Column Design</b>	Interaction equations. Effects of moment

		gradient loading. Design resistance of beam-column members Methods of Analysis for Required, Strength, The Moment Amplification Method, Braced versus Unbraced Frames, Members in Braced Frames, Members in Unbraced Frames, Design of Beam-Columns, Trusses with Top-Chord Loads Between, Joints
3.	<b>Plate girders</b>	Introduction, General Considerations, AISC Requirements for Proportions of Plate, Girders ; Flexural Strength, Shear Strength Bearing Stiffeners, Design
4.	<b>Connection: Welding and bolting and design codes and analysis of steel using computer software</b>	, Concept of welding process. Type of welded connections and failure mode. Design of welded connections, Type of bolted connections and failure mode. Design of bolted connections. Discussion of different design codes and analysis of steel structural system by using computer software

## 5.2. Sections of disciplines and types of classes

No	Discipline section No.	Lectures	Practice	Lab. works	Seminars	Independent work of students	Total hour
1.	<b>Introduction to steel structures</b>	4	8	0	0	14	26
2.	<b>Beam-Column Design</b>	4	10	0	0	14	28
3.	<b>Plate girders</b>	4	8	0	0	14	28
4.	<b>Connection: Welding and bolting and design codes and analysis of steel using computer software</b>	4	8	0	0	14	28

## 6. Laboratory workshop

No laboratory workshop provided.

## 7. Practical exercises (seminars)

No.	Discipline section No.	Subjects of practical classes (seminars)	Labor capacity (hour.)
1.	<b>Introduction to steel structures</b>	Introduction: Building codes, Seismic forces, Analysis, and design of complex structures. Loads, philosophy of design, steel and properties,	10
2.	<b>Beam-Column Design</b>	Interaction equations. Effects of moment gradient loading. Design resistance of beam-column members Methods of Analysis for Required, Strength, The Moment Amplification Method, Braced versus Unbraced Frames, Members in Braced Frames, Members in Unbraced Frames, Design of Beam-Columns, Trusses with Top-Chord Loads Between, Joints	10
3.	<b>Plate girders</b>	Introduction, General Considerations, AISC Requirements for Proportions of Plate, Girders ; Flexural Strength, Shear Strength Bearing Stiffeners, Design	10
4.	<b>Connection: Welding and bolting and</b>	, Concept of welding process. Type of welded connections and failure mode. Design of welded connections, Type of bolted connections and failure mode. Design of bolted	18

	<b>design codes and analysis of steel using computer software</b>	connections. Discussion of different design codes and analysis of steel structural system by using computer software	
	<b>Total:</b>		48

### 8. Material and technical support of the discipline:

(describes the material and technical bases necessary for the implementation of the educational process in the discipline (module)).

<b>Audience with a list of material and technical support</b>	<b>Location</b>
<b>Lecture hall No. 408</b> Equipment and furniture: - technical means: - projection screen; - Epson EH-TW 3200 multimedia projector; - a set of specialized furniture: tables, benches, chairs, blackboard.	city of Moscow, Ordzhonikidze str., 3
<b>Training room for seminars, practical classes, current control and intermediate certification No. 418</b> Equipment and furniture: - training models; - screen; - NEC Z projector; - set of specialized furniture: tables, benches, chairs, blackboard.	city of Moscow, Ordzhonikidze str., 3
<b>Educational and methodical office for independent, research work of students and course design No. 417</b> (Laboratory of engineering equipment of buildings and Structures ) - a set of specialized furniture; - chalkboard, markerboard ; - ASUS computers-5 pcs., ASER monitors-5 pcs.; - Microlab System Subwoofer-1 pc.; - проектор EPSON EB X11 projector	. Moscow, Ordzhonikidze str., 3

### 9. Informational support of the discipline

(A list of information technologies used in the implementation of the educational process in the discipline (module), including a list of software and information reference systems (if necessary))

a) Software: PowerPoint

b) databases, information and reference systems and search engines:

1. RUDN University Online Library.
2. Guidelines for completing homework.
3. Tasks for completing homework on the personal page of the teaching staff in electronic form.
4. A point-rating system for evaluating students ' knowledge, displayed on the teacher's personal page.

### 10. Educational and methodological support of the discipline:

a) main literature

Basic literature:

1. Handbook of structural steel connection design and details. Akbar R. Tamboli.  
<https://drive.google.com/file/d/1F2qQ2Ae8VOOyP-p2K4JxByBWjcaFtBvl/view>

additional literature

1. Filippo Berto (Ed.), Ricardo Branco (Ed.). Mechanical Behavior of High-Strength Low-Alloy Steels [Электронный ресурс] 2018. 1 с. ISBN 9783038972044 URL:  
<https://www.mdpi.com/books/pdfview/book/767>

2. Smart Lesley, Gagan Michael. Structures of metals [Электронный ресурс] // The Molecular World: The Third Dimension. 2002. ISBN 0-85404-660-7 DOI:  
<http://dx.doi.org/10.1039/9781847557902-00015>

3. Al-Samman T. Material and Process Design for Lightweight Structures [Электронный ресурс] 2019. 1 с. ISBN 9783038979586  
URL: <https://mdpi.com/books/pdfview/book/1319b>

### **11. Methodical instructions for students on mastering the discipline (module)**

Methodological guidelines for students on the development of the discipline (module)

Lectures are delivered in classrooms equipped with technical training facilities and video projectors. Lectures should be presented in the form of PowerPoint presentations.

Laboratory work is carried out in a laboratory fully equipped for laboratory work.

Practical classes are held in classrooms equipped with technical training facilities. Practical tasks are analyzed, as well as examples of solving computational and graphical tasks.

Control measures consist of two control works (for 2 ak. one hour each), exam at the end of the semester.

Methodological recommendations for the student are posted in the TUIS.

### **12. Fund of assessment tools for intermediate certification of students in the discipline (module)**

Materials for assessing the level of mastering the educational material of the discipline "Structural Design in Steel: Special Topics", including a list of competencies indicating the stages of their formation, a description of indicators and criteria for evaluating competencies at various stages of their formation, a description of the assessment scales, typical control tasks or other materials necessary to assess knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities that characterize the stages of the formation of competencies are developed in full and are available for students on the discipline page in TUIS RUDN.

The program is compiled in accordance with the requirements of the ES HE in the RUDN.

### **Developers:**

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